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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also incouded. (Pages 12 and 13, performance evaluation chart, will reproduce poorly because of marginal legibility.) (AG)

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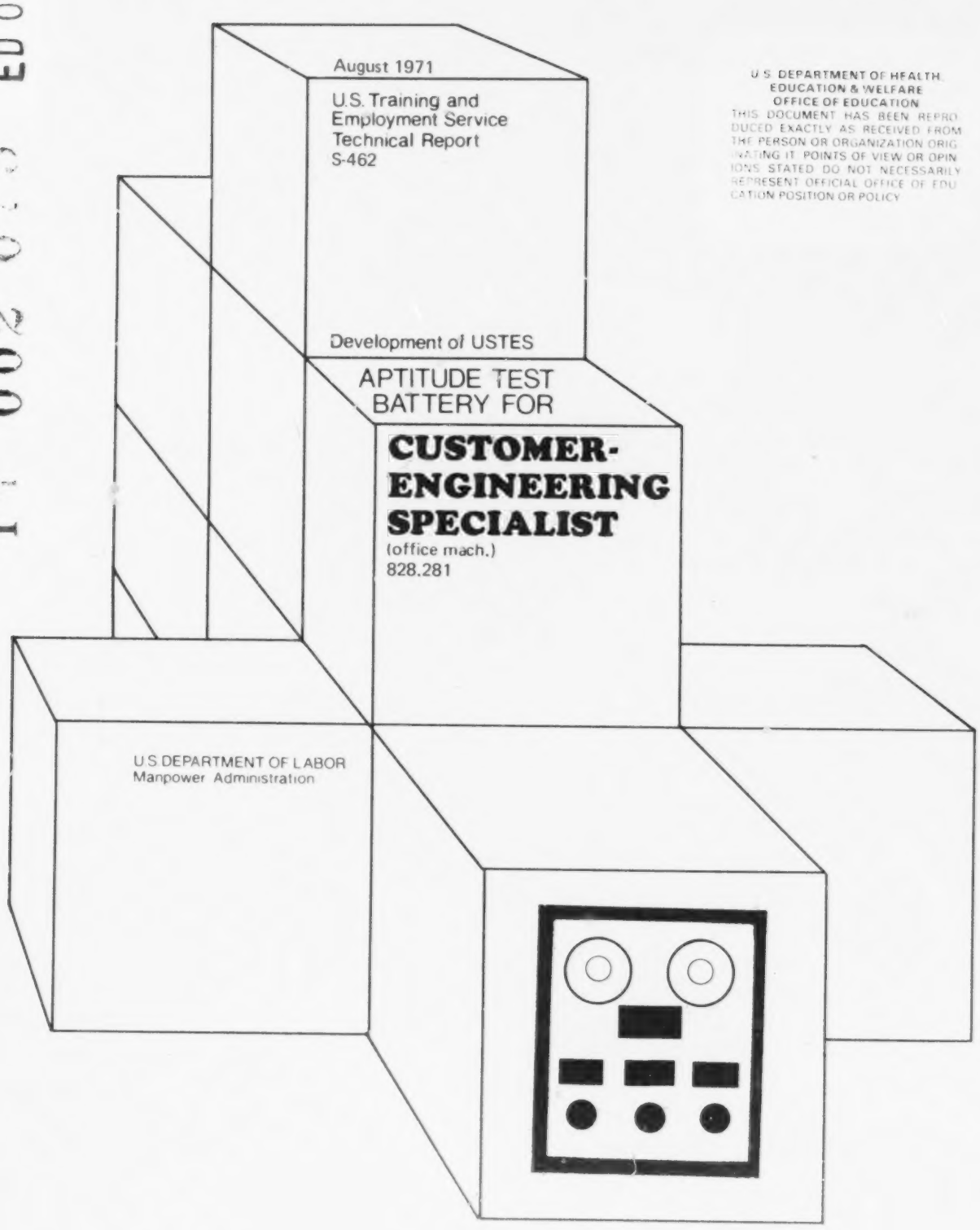

ED 069643

Technical Report on Development of USTES Aptitude Test Battery

For . . . . . .

Customer-Engineering Specialist (office mach.) 828.281

S-462

(Developed in Cooperation with the
New York State Employment Service)

U. S. Department of Labor
Manpower Administration

August 1971

FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2805

DEVELOPMENT OF USTES APTITUDE TEST BATTERY

For

Customer-Engineering Specialist (office mach.) 828.281-014

S-462

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Customer-Engineering Specialist (office mach.) 828.281. The following norms were established.

GATB Aptitudes	Minimum Acceptable GATB Scores
N-Numerical Aptitude	105
S-Spatial Aptitude	105
P-Form Perception	100
M-Manual Dexterity	85

RESEARCH SUMMARY

Sample:

55 male workers employed by Friden Corporation in 40 cities in 19 States. All sample members were receiving training at the Eastern training facility in Rochester, N.Y. Minority group information was available for only 21 sample members. All 21 individuals were non-minority group members.

Criterion:

Supervisory ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time.)

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations, and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .26 ($P/2 < .05$)

Effectiveness of Norms:

Only 67% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 79% would have been good workers. 33% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 21% would have been poor workers. The effectiveness of the norms is shown in Table 1:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	67%	79%
Poor Workers	33%	21%

VALIDATION SAMPLE DESCRIPTION

Size:

N = 55

Occupational Status:

Employed workers

Work Setting:

Workers were employed at Friden installations in 40 cities in 19 States as follows:

Alabama - Huntsville 1, Mobile 1
Arizona - Phoenix 1
Delaware - Wilmington 2
Florida - Jacksonville 2
Louisiana - New Orleans 1
Maryland - Baltimore 1
Massachusetts - Boston 1, Springfield 2
Michigan - Detroit 1
Missouri - St. Louis 2
New Jersey - Trenton 1
New York - Albany 1, Brooklyn 1, Buffalo 1, Rochester 1, Syracuse 1, Utica 1
North Carolina - Charlotte 2, Greensboro 2
Ohio - Canton 2, Cincinnati 3, Cleveland 1, Columbus 2, Mansfield 1
Toledo 1, Youngstown 1
Pennsylvania - Allentown 1, Erie 2, Pittsburgh 2, York 2
Rhode Island - Providence 2
Tennessee - Knoxville 1, Memphis 1
Texas - El Paso 1, Houston 1
Virginia - Norfolk 2, Richmond 1, Roanoke 1
West Virginia - Charleston 1

Employer Selection Requirements:

Education: High school graduate or equivalent
Experience: Minimum one year as Customer Service trainee for which pre-requisites were successful completion of centralized training courses in one product group:

Calculator-adder machine group
Mailroom equipment

Tape operated and auxiliary equipment
Electronic product group

Plus at least one year as Customer Service Representative with successful completion of further training in one or more of the same groups, or six months on-the-job training, with a minimum total service as Trainee and Representative of 36 months.

Tests: With a beginning trainee, the Bennett Test of Mechanical Comprehension was used moderately often, to "confirm learning from experience." In the current sample, the percentile scores of 21 of the 55 were secured. After basic training, every trainee was tested for electrical and electronic knowledge. Such basic training was a prerequisite to the other courses. The Pearson r for the Bennett and the criterion for the N=21 was -.315.

Other: Personal interview and physical examination.

Principal Activities:

The job duties for each worker are those shown in the job description on the Fact Sheet.

Minimum Experience:

All workers had completed a total of 36 months experience as Trainee and Representative.

TABLE 2

Means, Standard Deviations (SD), Ranges,
and Pearson Product-Moment Correlations
With the Criterion (r) for Age, Education and Experience

	Mean	SD	Range	r
Age (years) (N=55)	31.5	6.0	21-53	.192
Education (years) (N=54)	12.5	1.0	10-16	.079
Experience (months*) (N=49)	33.2	21.5	0-75	.270

*Since the collection of criterion data from such widespread sources resulted in delays of over a year in a number of cases, experience is of the date of the criterion collection.

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered to the sample during June 1968 and March 1969.

CRITERION

The criterion data consisted of supervisors' ratings of job proficiency.

Rating Scale:

A uniform company rating scale was used for this study. The scale consisted of seven factors, each with five alternatives of degree. Each item was given a unit weight, which was multiplied by 1 to 5 depending on its location on the scale.

The seven factors were used to rate the individual in isolation, and for this purpose were arranged in seven rows, with the five scale-positions for columns.

They were also used to rate the individual with his co-workers (most of whom had not been tested) and for this purpose the individuals' names were set in rows, and the seven factors made up seven columns, each divided into five subcolumns for scalar positions. In addition, each of the five subcolumns was given a limiting percentage to make up a forced distribution: 10%, 20%, 40%, 20% and 10% respectively of the total number being rated.

The individual rating described above is called an IF rating, an individual rating in the field, and the rating with the peers is called a GF, a group rating in the field. Whenever possible, the individual was given a second IF and GF rating several months later. The final criterion consisted of the first GF rating (GF-1) for 52 individuals. However, since these data were unavailable for three sample members, a second GF rating (GF-2) was used as the final criterion for one individual and 2 initial IF (IF-1) ratings were used for the other two individuals.

Reliability:

In the first round, 47 subjects were rated in their respective groups and later individually; the Pearson r resulting was .746, rather lower than expected in view of possible contamination.

In the second round, months later, 22 subjects; GF-2's were collected and could be correlated with IF-2's; a coefficient of .770 resulted, to be compared with that given above.

However, it should be pointed out that 20 of the 47 subjects in the former r (.746) and 20 of the 22 subjects in the latter (.770) were identical persons in the two rounds. When the data for these 20 are separated out, the correlation between their GF-1's and IF-1's was .841, and between their GS-2's and IF-2's was .810; their reliability and stability are clearly satisfactory.

An overall estimate of reliability is possible by taking all 49 subjects who had GF-1's to be compared with IF-1's and/or GF-2's to be compared with IF-2's. An N of 69 pairings of GF with IF is thus possible, and the resultant coefficient turns out to be .757.

In summary, it seems that all indications are that the reliabilities are adequate, in spite of the great number of ratees involved in the widespread field location of the relatively large number of raters.

Criterion Score Distribution:

Possible Range:	50-250
Actual Range:	76-240
Mean:	173.2
Standard Deviations:	36.4

Criterion Dichotomy:

The criterion distribution was dichotomized into low and high groups by placing 33% of the sample in the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated "good workers" and those in the low criterion group as "poor workers." The criterion critical score is 160.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout in the norms on the basis of a qualitative analysis of job duties involved and a statistical analysis of test and criterion data. Aptitudes G, V, N, S, P and M which do not have significant correlations with the criterion were considered for inclusion in the norms because qualitative analysis indicated they were important for job duties and the sample had a relatively high mean score on aptitudes G, S, P and M and a relatively low standard deviation on aptitudes G, V, N, Q, and M. Table 3, 4 and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
G - General Learning Ability	Complex training program and complicated mechanical and electrical products to be studied intensively.
V - Verbal Aptitude	Considerable reading of manuals, with specialized technical terminology. Ability to explain and interpret to customers how to prevent difficulties.
N - Numerical Aptitude	Some simple calculation; some mathematical logic.
S - Spatial Aptitude	Need for cognitive map of components and their relationship.
P - Form Perception	Needed to inspect materials and parts for defects and to make visual diagnosis.
M - Manual Dexterity	Needed in handling hand tools and making repairs.

TABLE 4

Means, Standard Deviations (σ), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB (N=55).

Aptitudes	Mean	SD	Range	r
G - General Learning Ability	115.6	10.9	80-140	.021
V - Verbal Aptitude	105.9	10.1	86-137	-.007
N - Numerical Aptitude	111.1	11.6	84-135	-.006
S - Spatial Aptitude	121.8	14.4	84-153	.067
P - Form Perception	115.9	16.1	87-152	.058
Q - Clerical Perception	112.9	13.0	78-138	-.163
K - Motor Coordination	110.2	18.8	66-153	.094
F - Finger Dexterity	107.1	17.5	77-158	.056
M - Manual Dexterity	115.6	19.2	74-159	.084

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes G	V	N	S	P	Q	K	F	M
Job Analysis Data:									
Important	X	X	X	X	X				X
Irrelevant									
Relatively High Mean Score	X			X	X				X
Relatively Low Standard Deviation	X	X	X			X			
Significant Correlation with the Criterion									
Aptitudes to be Considered for Trial Norms	G	V	N	S	P				M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of the degree to which trial norms, consisting of various combinations of aptitudes G, V, N, S, P and M at trial cutting scores, were able to differentiate between 67% of the sample considered to be good workers and 33% of the sample considered to be poor workers. Trial cutting scores at five-point intervals approximately one standard deviation below the mean are tried because they will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores of slightly more than one standard deviation below the mean will eliminate about one-third of the sample. For four-aptitude trial norms, cutting scores slightly less than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Optimum differentiation for the occupation of Customer-Engineering Specialist (office mach.) 828.281 was provided by the norms of N-105, S-105, P-100 and M-85. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .26 (statistically significant at the .05 level).

TABLE 6
Concurrent Validity of Test Norms of
N-105, S-105, P-100 and M-85

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	11	26	37
Poor Workers	11	7	18
Total	22	33	55

Phi coefficient (ϕ) = .26 Chi square (χ^2_y) = 3.7

Significance level = $P/2 < .05$

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into an OAP. However, the occupation was placed as a "+" in OAP-35 which is shown in the 1970 edition of Section II of the Manual for the General Aptitude Test Battery based on job analysis information.

PERFORMANCE EVALUATION CHART

Form 721-2135L

loyee _____ Branch _____ Date 2/10/69

INSTRUCTIONS

Read all five specifications for the factor QUANTITY.

The term "SPECIFIED" for the factor QUANTITY means that measure of quantity which is reasonable for an average employee as determined by the immediate supervisor.

3. Determine which specification most nearly fits the performance of the employee.

4. Place an X in the box of the specification which most nearly fits the performan the employee.

5. Repeat for the factors QUALITY, KNOWLEDGE OF JOB, INITIATIVE, COOPERAT WORK HABITS and CUSTOMER RELATIONS.

116

FACTOR					
QUANTITY Consider output of work during a given period of time.	☐ Output consistently low on most operations; A slow worker.	☒ Frequently turns out less than specified amount of work on many operations.	☐ Consistently turns out specified amount of work on most operations.	☐ Frequently turns out more than specified amount of work on many operations; A fast worker.	☐ Output outstandi high; Consistently tur out exceptionally larg amount of work.
QUALITY Consider extent to which work meets quality standards; Amount of spoilage, rejections, and rework.	☐ Work seldom meets specified quality; Many rejections, spoilages, or rework.	☒ Work frequently below specified quality; Apt to make mistakes; Moderate amount of rejections, spoilages, or rework.	☐ Work meets standards; A careful worker; Minor amount of rejections, spoilages, or rework.	☐ Work consistently meets specified quality; An accurate worker; Negligible amount of rejections, spoilages, or rework.	☐ Work of exceptional high quality; An outstan ingly precise & accurat worker; Rarely makes errors.
KNOWLEDGE OF JOB Consider Technical knowledge of all duties and assignments of job classification.	☐ Limited to the simplest duties or assignments within his classification. Lacks knowledge of other work within classification.	☐ Limited to selected duties or assignments within his classification. Has poor knowledge of other work within classification.	☒ Performs most of the duties or assignments within his classification; Has fair working knowledge of other work within classification.	☐ Performs any of the duties or assignments within his classification; Has good working knowledge of all work within classification.	☐ Excellent knowledge all duties or assignments within his classification. Has exceptionally good working knowledge of all work within classificatio
INITIATIVE/SELF-RELIANCE Consider ability to take action without being told. Requires minimum of supervision.	☐ Little drive. Requires abnormal amount of supervision.	☒ Sometimes hesitant to act. Demands direction in performance of work.	☐ Generally progressive. Completes most assignments with minor amount of supervision.	☐ Makes constructive suggestions for more efficient method of performing job. Requires little direction.	☐ Extremely resourc Rarely requires directi in performance of work.
COOPERATION Consider ability to work with others; To accept suggestions and direction; To understand & respond to needs & requirements of others.	☐ Does not work well with others, frequently irritates and aggravates others. Unwilling to accept suggestions and direction.	☐ At times, does not cooperate with others. Reluctant to accept suggestions and direction.	☒ Generally cooperative. Usually willing to accept suggestions and direction.	☐ Cooperates well with others. Willingly accepts suggestions and direction.	☐ Exceptionally cooper ative. Understanding an responsive to needs & re quirements of others. W lingly accepts suggestion and direction.
WORK HABITS Consider such things as attendance, punctuality, time-off, & adherence to governing Company regulations.	☐ Frequently fails to display good work habits.	☒ Occasionally fails to display good work habits.	☐ Displays good work habits.	☐ Displays excellent work habits.	☐ Displays outstandi work habits.
CUSTOMER RELATIONS Consider ability to instill customer confidence in self product, and to enhance Company image.	☐ Numerous complaints of poor office courtesy & lack of interest in customers requirements. Voices complaints of product and Company.	☒ Occasional complaints of lack of interest in customer requirements. Blames product or Company.	☐ Very few complaints. Usually instills customer confidence in self, product and Company.	☐ Excellent relations, complaints rare. Customer satisfied [illegible] Company [illegible]	☐ Exceptionally good t tomer relations. Custo voice complaints satisfied [illegible]

12

9

APPRAISAL FORM

Form 721-216SL 2.9

BRANCH

DATE

	QUANTITY Consider output of work during a given period of time.					QUALITY Consider extent to which work meets quality standards; Amount of spoilage, rejections, and re-work.					KNOWLEDGE OF JOB Consider Technical knowledge of all duties and assign-ments of job classi-fication.					INITIATIVE/SELF-RELIANCE Consider ability to take action without being told. Requires minimum of super-vision.					COOPERATION Consider ability to work with others; To accept suggestions and direction; To understand & respond to needs & require-ments of others.					WORK HABITS Consider such things as attendance, punctuality, time-off, & adherence to governing Company regulations					CUSTOMER RELA-TIONS Consider ability to in-still customer con-fidence in self & pro-duct, & to enhance Company image.					TOTAL POINTS
	8	16	24	32	40	8	16	24	32	40	10	20	30	40	50	4	8	12	16	20	6	12	18	24	30	4	8	12	16	20	10	20	30	40	50	
EN	10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	10	20	40	20	10	
					X					X					X				X					X					X				X		236
				X				X					X					X					X					Y				Y		158
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			Y	3	E	V		X	3				X	3				X	3				X	3				Y	3			Y	3	150
			Y						X					X					X					X						X				X		196
		X					Y					Y					X					X					X					Y			100
		X					X					X					X					X					Y					Y			100
	X					Y					X					Y					X					X					X				50

236, 210, 110, 150, (150 - 110 - 150 - 150) 100 - 10, 0

13

10

August 1971 S-462

FACT SHEET

Job Title: Customer-Engineering Specialist (office mach.) 828.281-014

Job Summary: Installs, repairs and services electronic equipment such as computers, electronic calculators, and auxiliary equipment at customers' establishments.

Work Performed:

Determines service plan by reference to written diagnostic and maintenance procedures and diagrams, including logic diagrams. Uses hand tools and electronic testing instruments, such as oscilloscope and multimeter. Keeps performance records of computypers and other electronic equipment serviced. Advises customers concerning operation and maintenance. Occasionally advises regarding programming of the computypers and other electronic equipment. (A large portion of the service and repair is accomplished by the module replacement method: individual modules of the machine are replaced, then individually serviced, repaired, and reinserted.)

Effectiveness of Norms:

Of the non-test-selected workers used for this study, 67% were good workers; if the workers had been test-selected with the S-462 norms, 79% would have been good workers. Of the non-test-selected workers, 33% were poor workers; if the workers had been test-selected with the S-462 norms, 21% would have been poor workers.

Applicability of S-462 Norms:

The aptitude test battery is applicable to jobs which include a majority of the job duties described above.

GPO 918-034

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